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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Sean S. B. Moore
Serial No.: 10/814,604
For: SYSTEM AND METHOD FOR EFFICIENT SCHEDULING OF PERIODIC PHENOMENA
Filing Date: March 31, 2004
Examiner: Abdullah Al Kawsar
Art Unit: 2195
Conf. No.: 5460

	Claims Remaining After Amendment	Highest No. Previously Paid For	Present Extra	Rate	Additional Fee
Total Claims	34	- 46	= 0	X $50.00	= $0.00
Independent Claims	3	- 8	= 0	X $210.00	= $0.00
				*** Month Extension of Time	= $0.00
				TOTAL ADDITIONAL FEE FOR THIS AMENDMENT	= $0.00

MAIL STOP AMENDMENT
Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

AMENDMENT

Sir:

In response to the Office Action mailed June 2, 2008, please amend the above-identified Application as follows:

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the Application:

LISTING OF CLAIMS:

1. (Currently amended) A method for modeling and structuring a scheduling system, said system including a plurality of tasks, a resource for servicing the tasks, and a scheduler that assigns the ~~set of~~ tasks to the resource, said method comprising:

~~the act of~~ defining tasks as cosets of subgroups of a mathematical group, wherein a coset comprises a subgroup of a group representing a resource;

defining a resource as said ~~mathematic~~ group;~~,~~ ~~and~~

defining a unit of measure for the resource in such a way as to assign an order, or size, to the group; and

wherein given a set of one or more subgroups with task generator values selected from the set $P = (p_1, p_2, \ldots p_k)$, the defining cosets for tasks further comprises selecting coset representatives *x* and *y* for any two tasks with subgroup generators p_i and p_j, respectively, such that $(x-y)$ is not evenly divisible by $g = gcd(p_i, p_j)$, where *gcd*() is the greatest common divisor function and where *g* is the greatest common divisor of p_i and p_j, wherein the cosets represent tasks, the groups represent resources, and units of measure are defined over any physical domain, including at least one of the group consisting of time, space, frequency, energy, speed, and mass.

2. Cancelled

3. (Original) The method of claim 1 wherein said system includes at least a first task represented by a coset and associated subgroup and at least a second task represented by a second coset and associated subgroup in which the

generator of the second subgroup is different from the generator of said first subgroup.

4. (Original) The method of claim 1 wherein said scheduling system includes a plurality of resources.

5. (Original) The method of claim 4 wherein said plurality of resources are distributed throughout a physical domain.

6. (Currently amended) The method of claim 1 wherein a task can be represented by a coset of a subgroup of the group representing a resource, and the coset ~~can be fully~~is represented by first and second values in which the first value includes a generator of the subgroup and the second value includes a coset representative.

7. (Currently amended) The method of claim 6 wherein a task ~~can be~~is represented by contiguous cosets of a group.

8. (Original) The method of claim 5 wherein said plurality of resources are represented by groups with at least two different orders.

9. (Currently amended) The method of claim 1 wherein said system includes a packet switching communications system having periodic scheduled task appointments for servicing a task.

10. (Currently amended) The method of claim 1 wherein said act of defining and measuring tasks as cosets and resources as groups includes the act of deriving a set of possible subgroups associated with said cosets from the value of N, the order o the group representing a resource, from the power set of the prime factors of N, where *N* is the order of said group representing said resource, wherein this set is equivalent to the set of subgroups of the (additive) group Z_N wherein if the prime factorization of $N = p_1p_2p_3\ldots p_j$, then the set of all possible

subgroup generators is composed of the 2^j values 1, p_1, p_2, p_3, …, p_j, p_1p_2, p_1p_3,…, p_1p_j, p_2p_3, p_2p_4, … p_2p_4, … p_2p_j, …, $p_1p_2p_3…p_j$.

11. Cancelled

12. (Currently amended) The method of claim 1 wherein said system supports tasks represented by subgroups with generator values selected from P = (p_1, p_2, …p_k), wherein P is a schedule period, and further including the act of uniquely assigning coset representatives to the tasks, where said coset representatives are selected from the set of values (0, 1, …*g*-1), where g = gcd(P), the greatest common divisor of all of the element values in P.

13. (Original) The method of claim 1 wherein said system includes a plurality of resources, said plurality of resources represented by groups with at least two different orders.

14. (Original) The method of claim 1 wherein said mathematical group is selected from a set of groups consisting of abelian mathematical groups and non-abelian mathematical groups.

15. (Original) The method of claim 1 wherein the set of subgroup generators is restricted to a subset that is smaller than said set of subgroup generators.

16. (Currently amended) The method of claim ~~11~~ 1 wherein the set of subgroup generators is restricted to a subset that is smaller than said set of subgroup generators.

17. (Original) The method of claim 1 in which the groups representing resources are chosen such that the intersection of costs representing tasks will be null.

18. (Currently amended) The method of claim 1 in which the unit of measure for a resource is chosenfrom the group consisiting of wherein ~~such that~~ the set of generator values of all of the subgroups of the group representing said resource

are not pairwise relatively prime, and wherein ~~or is chosen such that~~ the said set of generator values has a greatest common divisor that is relatively large.

19. (Original) The method of claim 5 in which the unit of measure is chosen such that the corresponding set of orders of the groups representing said plurality of resources has a greatest common divisor that is relatively large.

20. (Currently amended) The method of claim 1 further ~~including the act of~~comprising encoding system state information using at least one of the group consisting of group, subgroup, ~~or~~ and coset notations.

21. (Currently amended) The method of claim 1 wherein said scheduler identifies at least one of possible collision events before the possible collision events occur, and ~~, or equivalently the~~ elements of a non-null intersection of cosets that represent tasks~~,~~ before such possible events occur.

22. (Currently amended) A computer scheduling system comprising:

a memory;

a processor;

a communications interface;

an interconnection mechanism coupling the memory, the processor and the communications interface; and

wherein the memory is encoded with an application that when performed on the processor, provides a process for processing information, the process causing the computer system to perform the operations of:

~~scheduling system having~~providing a plurality of tasks, providing a resource for servicing the tasks, and providing a scheduler that identifies the plurality of tasks with cosets of subgroups of a group representing said resource, where said group is chosen by defining one or more units of measure for the resource in such a way as to index the resource by the elements of said ~~mathematical~~ group and wherein said scheduler derives a set of subgroups of said group representing said resource from the power set of the prime factors of *N*, where *N*

is the order of said group representing said resource, wherein said set is equivalent to the set of subgroups of the group Z_N wherein if the prime factorization of $N = p_1p_2p_3...p_j$, then said set of all subgroups has as task generators the values selected from the set of 2^j values, 1, p_1, p_2, p_3, …, p_j, p_1p_2, p_1p_3,…, p_1p_j, p_2p_3, p_3p_4, … p_2p_j, …, $p_1p_2p_3...p_j$, and wherein a task is represented by a coset of a subgroup, and the coset is represented by first and second values in which the first value includes a generator of the subgroup and the second value includes a coset representative

23. Cancelled

24. Cancelled

25. (Original) The system of claim 24 wherein given a set of one or more subgroups with generator values selected from the set $P = \{p_1, p_2, ...p_k\}$, the act of defining cosets for tasks further includes the act of selecting coset representatives *x* and *y* for any two tasks with subgroup generators p_i, and p_j, respectively, such that (*x*-*y*) is not evenly divisible by $g = gcd(p_i, p_j)$, where *gcd*() is the greatest common divisor function and therefore where *g* is the greatest common divisor of p_i and p_j.

26. (Currently amended) The system of claim 24 wherein said system supports tasks represented by subgroups with generator values selected from $P = \{p_1, p_2, ...p_k\}$, wherein P is a schedule period, and further including the act of uniquely assigning coset representatives to the tasks, where said coset representatives are selected from the set of values {0, 1,…*g*-1}, where *g* = *gcd*(P), the greatest common divisor of all of the element values in P.

27 - 28. Cancelled

29. (Currently amended) The method of claim 1 wherein given a set of coset representatives, the ~~act of~~ defining cosets for tasks further includes ~~the act of~~ selecting subgroups with generator values selected from a set $P = (p_1, p_2, ...p_k)$,

such that for any two tasks with coset representatives *x* and *y*, the two subgroups have generators p_1 and p_j selected such that (*x*-*y*) is not evenly divisible by *g* = *gcd*(p_i,p_j), where *gcd*() is the greatest common divisor function and therefore where g is the greatest common divisor of p_i and p_j.

30. (Currently amended) The method of claim 1 wherein said system supports tasks with coset representatives uniquely selected from a set of values (0, 1, … *g*-1), and further including ~~the act of~~ assigning subgroups to the tasks, wherein subgroup generator values are chosen from the set P = {p_1, p_2, …p_k} wherein P is a schedule period,, and further including ~~the act of~~ selecting the elements in P such that *gcd*(P), the greatest common divisor of the elements in P, is greater than or equal to *g*, where g is the joint greatest common divisor of p_i and p_j.

31 - 32. Cancelled

33. (Currently amended) A method for modeling and structuring a scheduling system operating in the time domain, said system including a plurality of periodic tasks, a resource for servicing the tasks, and a schedule period associated with the resource, and a scheduler that assigns the set of tasks to the resource, said method comprising:

_____~~the act of~~ defining and measuring task periods and said resource schedule period by one or more units of measure in such a way that measurement values for the task periods and the resource schedule period are indexed by elements of a mathematical group and wherein said act of defining and measuring task periods and resource schedule periods identifies the resource with Z_n, the group of integers modulo *N*, where *N* is the order of the group associated with said resource schedule period, and further includes deriving a set of possible task period values from the power set of the prime factors of *N*, wherein said set of task period values is equivalent to the set of subgroups of the group Z_N wherein if the prime factorization of N = $p_1p_2p_3…p_j$, then said set of task period values has

as elements the 2^j values 1, p_1, p_2, p_3, …, p_j, p_1p_2, p_1p_3, …, p_1p_j, p_2p_4, …p_2p_j, …, $p_1p_2p_3$ …p_j.

34. (Original) The method of claim 33 wherein said system includes at least a first periodic task having a first period and at least a second periodic task having a second period different from said first period.

35. Cancelled

36. (Currently amended) The method of claim 35 wherein given a set of one or more periodic tasks with rate values selected from R = {r_1, r_2, …r_k}, where r_j measures the number of service events for a task during a resource schedule period, and a corresponding set of flow periods P = {p_1, p_2, …p_k}, where $p_j = N/r_j$ and where N is the measure of the resource schedule period, further including ~~the act of~~ selecting and assigning to any two tasks any two rates p_i and p_j and coset representatives *x* and *y* such that the intersection of the cosets $<p_i>_x$ and $<p_j>_y$ is null by selecting (*x*-*y*) that is not evenly divisible by $g = gcd(p_i, p_j)$, where g is the joint greatest common divisor of p_i and p_j.

37. (Currently amended) The method of claim 35 wherein said system supports at least one of the group consisting of tasks with rates selected from a set R = {r_1, r_2, …r_k} ~~or equivalently with~~ and task period values selected from a corresponding set P = {p_1, p_2, …p_k}, where $p_j = N/r_j$, wherein P is a schedule period, and where N is the measure of the resource schedule period, further including ~~the act of~~ uniquely assigning coset representatives to the tasks, where said coset representatives are selected from the set of values (0, 1, … *g*-1), where $g = gcd(P)$, the greatest common divisor of all of the element values in P.

38. (Currently amended) The method of claim 33 wherein said system includes a plurality of resources, said plurality of resources represented by

groups Z_N with at least one of the group consisiting of at least two different values of *N*, ~~or equivalently with~~ and at least two different orders for said groups.

39. (Original) The method of claim 35 wherein the set of task periods is restricted to a subset that is smaller than said set of task periods.

40. (Currently amended) The method of claim 33 in which said resource schedule periods are chosen such that the intersection of cosets representing tasks ~~with be~~ are null.

41. (Currently amended) The method of claim 33 in which the unit of measure for said resource schedule period is chosen from the group consisting of such that the said set of task period values are not pairwise relatively prime ~~or~~and ~~chosen~~ such that said set of task period values has a greatest common divisor that is relatively large.

42. (Currently amended) The method of claim 35 in which the unit of measure for said resource schedule period is chosen from the group consisting of such that the said set of task period values are not pairwise relatively prime ~~or chosen~~ and such that said set of task period values has a greatest common divisor that is relatively large.

43. (Original) The method of claim 33 in which the unit of measure is chosen such that the corresponding set of orders of the groups representing said plurality of resources has a greatest common divisor that is relatively large.

44.-46. Cancel

REMARKS

In response to the Office Action mailed June 2, 2008, Applicants respectfully requests reconsideration. To further the prosecution of this Application, Applicants submits the following remarks, and have canceled claims. The claims as now presented are believed to be in allowable condition.

Claims 1-46 were pending in this Application. By this Amendment, claims 2, 11, 27, 28, 23, 24, 31, 32, 35 and 44-46 have been canceled. Applicants expressly reserve the right to prosecute at least some of the canceled claims and similar claims in one or more related Applications. Claims 1, 22 and 33 are independent claims.

Claims 10, 11, 16, 24-26, 29, 35-37 , 39 and 42 were objected to as being dependent on a rejected base claim but were deemed allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims. Applicants have amended claim 1 to include the limitations of claim 11 and have amended claim 22 to include the limitations of claim 24 and have amended claim 33 to include the limitations of claim 35, accordingly claims 1, 22 and 35 are now allowable. Claims 3-10, 12-21, 25-26, 29-30, 34 and 36-43 depend from claim s1. 22 or 33 and are believed allowable as they depend from a base claim which is believed allowable.

Claims 22-28 and 45 were rejected under 35 U.S.C. §101. Claims 22 has been amended and claim 45 has been cancelled. Accordingly, the rejection of claims 22-28 and 45 is believed to have been overcome.

Claims 1-46 were rejected under 35 U.S.C. 12, second paragraph, as being indefinite. The claims have been amended to overcome the indefiniteness cited by the Examiner. Accordingly, the rejection of claims 1-46 under 35 U.S.C. §112, second paragraph, is believed to have been overcome.

The Examiner rejected claims 1-9, 13-15, 17-23, 27-28, 31-34, 38, 40-41 and 44-46 under 35 U.S.C §102(b) as being anticipated by U.S. Patent No. 5,745,778 to Alfieri. The Examiner rejected claims 12, 30 and 43 under 35 U.S.C. §103(a) as being unpatentable over Alfieri. Claims 1, 22 and 33 have amended to include the limitations of an allowable dependent claim, thereby making the independent claims 1, 22 and 33 allowable. The claims depending from these allowable base claims are also allowable. Accordingly, the rejections of the pending claims is believed pt have been overcome.

The prior art of record is not believed to disclose or suggest the present invention.

In view of the above, the Examiners objections and rejections are believed to have been overcome, placing the pending claims in condition for allowance ad reconsideration and allowance thereof is respectfully requested.

Applicants hereby petitions for any extension of time which is required to maintain the pendency of this case. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 50-3735.

If the enclosed papers or fees are considered incomplete, the Patent Office is respectfully requested to contact the undersigned collect at (508) 616-9660, in Westborough, Massachusetts.

Respectfully submitted,

/DWR/

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Attorney Docket No.: AVA06-59

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